Refine Search

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L15 and L1	29

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Search: L16

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Thursday, June 01, 2006 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=USPT; PLUR=YES; OP=OR		
L16	L15 and l1	29	L16
L15	quality same channel	26253	L15
	DB=USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR		
L14	L13 and l8	10	L14
L13	L12 same packet	154	L13
L12	L11 same radio	698	L12
L11	L10 same protocol	1969	L11
L10	bluetooth	9121	L10
L9	L8 same error same command	16	L9
L8	quality same channel same packet	2042	L8
	DB=USPT,PGPB; PLUR=YES; OP=OR		
L7	('4110558'| '4138678'| '4584685'| '4716573'| '4967413'| '5001776'| '5371737'| '5430743'| '5477550')![pn]	9	L7

L6	('4720829'| '4727546'| '5068724'| '5172228'| '5649051'| '5734962'| '5809043'| '5815515'| '5835508'| '5844922'| '5946320'| '5996104')![pn]	12	L6
DB=USPT; PLUR=YES; OP=OR			
L5	L4 and l1	1	L5
L4	adaptiv$ same quality same channel	956	L4
L3	L2 and l1	0	L3
L2	adaptiv$ same quality same channel same error	245	L2
L1	(ton near1 david)[xa,xp]	518	L1

END OF SEARCH HISTORY

Refine Search

Search Results -

Terms	Documents
L2 and L1	25

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US Pre-Grant Publication Full-Text Database
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IBM Technical Disclosure Bulletins

Search: L3

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Thursday, June 01, 2006 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
DB=USPT; PLUR=YES; OP=OR			
L3	L2 and l1	25	L3
L2	quality same channel same packet	1476	L2
L1	bluetooth same protocol	1394	L1

END OF SEARCH HISTORY

L3: Entry 13 of 25 File: USPT Nov 15, 2005

DOCUMENT-IDENTIFIER: US 6965590 B1
TITLE: Dynamic slave selection in frequency hopping wireless communications

Brief Summary Text (4):
Present telecommunication system technology includes a wide variety of wireless networking systems associated with both voice and data communications. An overview of several of these wireless networking systems is presented by Amitava Dutta-Roy, Communications Networks for Homes, IEEE Spectrum, pg. 26, December 1999. Therein, Dutta-Roy discusses several communication protocols in the 2.4 GHz band, including IEEE 802.11 direct-sequence spread spectrum (DSSS) and frequency-hopping (FHSS) protocols. A disadvantage of these protocols is the high overhead associated with their implementation. A less complex wireless protocol known as Shared Wireless Access Protocol (SWAP) also operates in the 2.4 GHz band. This protocol has been developed by the HomeRF Working Group and is supported by North American communications companies. The SWAP protocol uses frequency-hopping spread spectrum technology to produce a data rate of 1 Mb/sec. Another less complex protocol is named Bluetooth after a 10.sup.th century Scandinavian king who united several Danish kingdoms. This protocol also operates in the 2.4 GHz band and advantageously offers short-range wireless communication between Bluetooth devices without the need for a central network.

Brief Summary Text (5):
The Bluetooth protocol provides a 1 Mb/sec data rate with low energy consumption for battery powered devices operating in the 2.4 GHz ISM (industrial, scientific, medical) band. The current Bluetooth protocol provides a 10-meter range and a maximum asymmetric data transfer rate of 723 kb/sec. The protocol supports a maximum of three voice channels for synchronous, CVSD-encoded transmission at 64 kb/sec. The Bluetooth protocol treats all radios as peer units except for a unique 48-bit address. At the start of any connection, the initiating unit is a temporary master. This temporary assignment, however, may change after initial communications are established. Each master may have active connections of up to seven slaves. Such a connection between a master and one or more slaves forms a "piconet." Link management allows communication between piconets, thereby forming "scattemets." Typical Bluetooth master devices include cordless phone base stations, local area network (LAN) access points, laptop computers, or bridges to other networks. Bluetooth slave devices may include cordless handsets, cell phones, headsets, personal digital assistants, digital cameras, or computer peripherals such as printers, scanners, fax machines and other devices.

Brief Summary Text (6):
The Bluetooth protocol uses time-division duplex (TDD) to support bi-directional communication. Frequency hopping permits operation in noisy environments and permits multiple piconets to exist in close proximity. The frequency hopping scheme permits up to 1600 hops per second over 79 1-MHZ channels or the entire 2.4 GHz ISM spectrum. Various error correcting schemes permit data packet protection by 1/3 and 2/3 rate forward error correction. Further, Bluetooth uses retransmission of packets for guaranteed reliability. These schemes help correct data errors, but at the expense of throughput.

Brief Summary Text (7):

The Bluetooth protocol is specified in detail in Specification of the Bluetooth System, Version 1.0A, Jul. 26, 1999, which is incorporated herein by reference.

Brief Summary Text (8):
In frequency hopping wireless communications systems such as the Bluetooth system, there can be considerable variation in the quality of the channel at various frequencies due, for example, to different fading and interference conditions at each frequency. Transmission on frequencies with low E.sub.b /(N.sub.O +I.sub.O) (signal-to-noise+interference ratio) usually results in many bit errors, which leads either to poor voice quality in voice transmissions or lost data packets in data transmissions.

Detailed Description Text (5):
The scheduler 16 includes an input 19 for receiving conventionally available information indicative of the quality of the channel to each slave for all available transmit frequencies, so that the scheduler will know the best frequencies available for transmission to each slave. The scheduler 16 also has an input 20 for receiving conventionally available information indicative of the normal frequency hopping pattern utilized by the wireless communications interface 12. The scheduler 16 also receives at 21 from the packet processor 11 the normal flow of master-to-slave (MS) packets conventionally produced by the packet processor 11 from the communication information provided by communications application 13. Based on the frequency hopping pattern information at 20 and the frequency channel quality information at 19, the scheduler 16 outputs at 22 to the wireless communications interface 12 a modified master-to-slave packet flow that avoids poor frequencies and utilizes stronger frequencies. The scheduler can also receive at 17 information indicative of the quality-of-service required for communication to a given slave, and/or the amount of information that needs to be transmitted to a given slave. The quality-of-service information can be used by the scheduler to select a best frequency from among a plurality of adequate frequencies for transmission to a given slave. If the information at 17 indicates that a large amount of information needs to be transmitted to a given slave, the scheduler may increase the size of that slave's packet(s) in the modified packet flow 22.

Detailed Description Text (6):
The frequency channel quality information at 19 can, in some Bluetooth embodiments, be based upon the value of the correlation with the sync word for packets received by the master. If the sync word correlation value is high, then the E.sub.b (N.sub.O +I.sub.O) will usually be high. Another exemplary indicator of frequency channel quality is the CRC (cyclic redundancy code) of received data packets. This CRC can be checked to determine whether the packet was received correctly, which would indicate whether or not the channel is acceptable. Another example of frequency channel quality information is the conventional Bluetooth acknowledgment (ACK) or negative acknowledgment (NAK) received from the slave device(s) in response to a previous master-to-slave transmission, the negative acknowledgment indicating a potential problem with the quality of that frequency channel. Additionally, an estimate of the coherence bandwidth can be made to determine whether nearby frequencies will have fading characteristics that are similar to a given frequency, thus providing additional frequency channel quality information.

Detailed Description Text (9):
In a further example, if the channel quality for the frequency specified by the normal frequency hopping pattern for transmission to a given slave is very good, and/or if the master device has a large amount of information for transmission to that slave, then the scheduler 16 may choose to send a larger packet to that slave to take advantage of the good channel quality. Also, if it is determined that an upcoming frequency in the normal frequency hopping pattern provides a poor channel to all of the slave devices, for example due to a temporary fading condition, then the scheduler 16 may choose to avoid that upcoming frequency by transmitting a larger packet to one of the slaves before the poor frequency is reached. In systems

such as the Bluetooth system, the transmission frequency does not change in the middle of the packet, so the identified poor frequency can be avoided (i.e., bypassed) until its quality improves.

Detailed Description Text (10):
In another exemplary embodiment, both the master-to-slave (MS) transmission frequency and the slave-to-master (SM) transmission frequency specified by the normal frequency hopping pattern can be considered by the scheduler 16. In such embodiments, the scheduler evaluates the channel quality of both the master-to-slave frequency and the corresponding slave-to-master frequency for a plurality of possible master-to-slave/slave-to-master frequency pairs, and selects a pair that provides acceptable channel quality. The aforementioned technique of increasing the size of the master-to-slave packet can also be used to bypass poor frequencies until a master-to-slave/slave-to-master frequency pair of acceptable quality is reached.

Detailed Description Text (11):
FIG. 2 diagrammatically illustrates exemplary Bluetooth ACL (Asynchronous Connection-Less) communication of packets between the master device of FIG. 1 and two conventional ACL slave devices. In the example of FIG. 2, the scheduler 16 sends the first two packets to slave 1 on frequencies f.sub.1 and f.sub.3 of the normal frequency hopping pattern, because the channel quality to and from slave 1 is better than the channel quality to and from slave 2. Slave 1 responds on the frequencies f.sub.2 and f.sub.4 specified by the normal frequency hopping pattern. For the third and fourth transmissions on frequencies f.sub.5 and f.sub.9, the scheduler of FIG. 1 chooses to transmit to slave 2, and for the fifth and sixth transmissions on frequencies f.sub.11 and f.sub.17, the scheduler chooses to transmit again to slave 1. As shown in FIG. 2, both the master and the slave devices transmit on the frequencies specified by the normal frequency hopping pattern, and the master device transmits extended length packets (conventionally available in Bluetooth systems) on frequencies f.sub.5, f.sub.11 and f.sub.17. As mentioned above, extended packet lengths may be specified by the scheduler 16, for example, in order to take advantage of good channels and/or to accommodate larger data transmissions.

Detailed Description Text (22):
FIG. 12 illustrates exemplary operations which can be performed by the master devices of FIGS. 1 and 4. After obtaining frequency channel quality information at 120, a packet transmission to a given slave is scheduled at 121 based on the quality information. For Bluetooth ACL links, the scheduling can also include selecting the packet length based on the quality information and the amount of information that needs to be transmitted to the slave. Thereafter, the packet is transmitted as scheduled at 123, after which the illustrated operations can be repeated.

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L3: Entry 9 of 25 File: USPT Jan 17, 2006

DOCUMENT-IDENTIFIER: US 6987955 B1
TITLE: Approach for managing power for communications channels based on performance

Brief Summary Text (10):
An example of a frequency hopping protocol is the Institute of Electrical and Electronics Engineers (IEEE) 802.15.1 Wireless Personal Area Network Standard, which is based on the Bluetooth.TM. wireless personal area network (WPAN) technology from the Bluetooth Special Interest Group (SIG). The BLUETOOTH trademarks are owned by Bluetooth SIG, Inc., U.S.A. The Bluetooth protocol uses 79 individual randomly chosen frequency channels numbered from 0 to 78 and changes the frequencies 1600 times per second. Examples of NFH systems include the IEEE 802.11b Wireless Local Area Network (WLAN) in non-frequency hopping mode, which is the mode that typically is used, and the IEEE 802.15.3 next-generation WPAN, both of which operate in the 2.4 GHz Industrial, Scientific, Medical (ISM) band, which is an unlicensed portion of the radio spectrum that may be used in most countries by anyone without a license.

Brief Summary Text (12):
A common problem for communications systems is poor transmission quality of communications channels, also referred to as poor channel performance, which results in data transmission errors. For example, poor channel performance may increase the bit error rate (BER), which results in the loss of packets, leading to reduced transmission quality and reduced throughput (e.g., the amount of information successfully transmitted and received). As used herein, a "data packet" is a block of data used for transmissions in a packet-switched system, and the terms "data packet" and "packet" are synonymous.

Description Paragraph (29):
In block 110, the master participant sends a packet to the slave participant. For example, the packet may be a Bluetooth packet sent over one of the seventy-nine (79) Bluetooth channels that is selected based on the Bluetooth FH protocol.

Description Paragraph (47):
The techniques discussed herein are described with respect to master participants, slave participants, and wireless FH systems such as Bluetooth. However, other communications protocols may be used, including but not limited to, fixed data rate systems and dynamic or rare adaptive systems. For example, Bluetooth is an example of a fixed data rate system in which data is transferred at a fixed rate, such as 1 MB/sec. Because the data rate is fixed, the data rate does not change. As another example, IEEE 802.11 and IEEE 802.15 described scalable data rate systems, also referred to as dynamic or rare adaptive systems, in which the data rate can be adjusted, such as from 1 MB/sec to 11 MB/sec for WLAN. In addition, the techniques applied herein may be used with both single channel and multiple channel communications systems, whether or not implemented according to a wireless communications protocol.

Description Paragraph (78):
FIG. 5A is a block diagram that depicts a power request table 500 for a participant, according to an embodiment of the invention. It is assumed for the example depicted in FIG. 5A that power request table 500 is maintained by slave

participant P3 for communications that are received from master participant P4 in communications arrangement 200 that uses the Bluetooth FH protocol. However, in general any participant can maintain power request information for communications received from one or more other participants, and other communications protocol besides FH protocols may be used.

Description Paragraph (122):
As another example, a cyclic redundancy check (CRC) may be used to test the performance of communications channels. The CRC may be a check of either the payload of the packet or the complete contents of the packet, depending on the communications system protocol being used. As an example, in Bluetooth and IEEE 802.15.1, the data packet must pass a CRC check, otherwise the packet must be retransmitted. A retransmission request (RR) indicates poor channel performance.

Description Paragraph (139):
FIG. 8A is a block diagram that depicts a master power request table 800, according to an embodiment of the invention. Assume for the example depicted in FIG. 8A that master power request table 800 is maintained by master participant P4 of communications arrangement 200 that operates according to the Bluetooth FH protocol. However, in general any participant may maintain power request information for one or more other participants and for one or more channels in any type of communications systems besides Bluetooth based FH systems.

Description Paragraph (147):
FIG. 8B is a block diagram that depicts a slave power request table 850, according to an embodiment of the invention. Assume for the example depicted in FIG. 8B that slave power request table 850 is maintained by slave participant P3 of communications arrangement 200 that operates according to the Bluetooth FH protocol. However, in general any participant may maintain power request information for one or more other participants and for one or more channels in any type of communications systems besides Bluetooth based FH systems.

Description Paragraph (153):
FIG. 9A is a block diagram that depicts a master transmit power table 900, according to an embodiment of the invention. Assume for the example depicted in FIG. 9A that master transmit power table 900 is maintained by master participant P4 of communications arrangement 200 that operates according to the Bluetooth FH protocol. However, in general any participant may maintain power request information for one or more other participants and for one or more channels in any type of communications systems besides Bluetooth based FH systems. For explanation purposes, master transmit power table 900 is described with reference to master power request table 800 of FIG. 8A and slave power request table 850 of FIG. 8B.

Description Paragraph (157):
FIG. 9B is a block diagram that depicts a slave transmit power table 950, according to an embodiment of the invention. Assume for the example depicted in FIG. 9A that slave transmit power table 950 is maintained by slave participant P3 of communications arrangement 200 that operates according to the Bluetooth FH protocol. However, in general any participant may maintain power request information for one or more other participants and for one or more channels in any type of communications systems besides Bluetooth based FH systems. For explanation purposes, slave transmit power table 950 is described with reference to master transmit power table 900 of FIG. 9A, master power request table 800 of FIG. 8A, and slave power request table 850 of FIG. 8B.

Description Paragraph (205):
In the foregoing specification, the invention has been described with reference to specific embodiments thereof. It will, however, be evident that various modifications and changes may be made thereto without departing from the broader spirit and scope of the invention. For example, although examples have illustrated

the use of a communications arrangement that operates based on the Bluetooth wireless FH protocol, the Bluetooth protocol is used for explanation purposes only as embodiments of the invention are not limited to any particular type of communications protocol. Thus, the specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense. The invention includes other contexts and applications in which the mechanisms and processes described herein are available to other mechanisms, methods, programs, and processes.

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L3: Entry 2 of 25 File: USPT May 16, 2006

DOCUMENT-IDENTIFIER: US 7046644 B1
TITLE: Adaptive transmission channel allocation method and system for ISM and unlicensed frequency bands

Brief Summary Text (7):
The Bluetooth operating frequency is globally available, but the permissible bandwidth of the Bluetooth band and the available RF channels may be different from one country to another. Globally, the Bluetooth operating frequency falls within the 2400 MHz to 2497 MHz range. In the U.S. and in Europe, a band of 83.7 MHz bandwidth is available, and the band is divided into 79 RF channels spaced 1 MHz apart. Bluetooth network arrangements can be either point-to-point or point-to-multipoint to provide connection links among a plurality of electronic devices. Two to eight devices can be operatively connected into a piconet, wherein, at a given period, one of the devices serves as the master while the others are the slaves. Several piconets may form a larger communications network known as a scattemet, with each piconet maintaining its independence. The baseband protocol for a Bluetooth system combines circuit and packet switching. Circuit switching can be either asynchronous or synchronous. Up to three synchronous data (logical) channels, or one synchronous and one asynchronous data channel, can be supported on one physical channel. Each synchronous channel can support a 64 Kb/s transfer rate while an asynchronous channel can transmit up to 721 Kb/s in one direction and 57.6 Kb/s in the opposite direction. If the link is symmetric, the transfer rate in the asynchronous channel can support 432.6 Kb/s. A typical Bluetooth system consists of a radio link, a link control unit and a support unit for link management and host terminal interface functions. The Bluetooth link controller carries out the baseband protocols and other low-level routines. Link layer messages for link set-up and control are defined in the Link Manager Protocol (LMP). In order to overcome the problems of radio noise interference and signal fading, frequency hopping is currently used to make the connections robust.

Description Paragraph (29):
FIGS. 1a through 1g are diagrammatic representations illustrating the establishment procedure of a connection link in a piconet 10 having a plurality of devices M, S1, S2, S3 and S4 which are capable of being connected in a frequency-hopping fashion. The frequency-hopping connection links are well known in the art, and such a connection is referred to herein as a BT 1.0 connection link, associated with the Bluetooth Specification Version 1.0 (BT 1.0). As shown, M is currently a master device and S1, S2, S3 and S4 are slave devices. The procedure described here is limited to the case where a slave device wishes to establish a connection link with another slave device in a non-frequency-hopping fashion. The non-frequency-hopping fashion is herein referred to as BT 2.0. As shown in FIG. 1a, the connection links 102, 104, 106 and 108 between the master device M and the slave devices S1, S2, S3 and S4 are initially established according to the BT 1.0 fashion. At any time, any one of the slave devices S1, S2, S3 and S4 can send a request to the master device M requesting a BT 2.0 link setup with another slave device. For illustrative purposes, in the initialization phase the slave device S2 is the initiating unit which wishes to set up a BT 2.0 connection link with the slave device S4, for example. Alternatively, the master device M may initiate the high-speed, or BT 2.0, connection link between slave devices. As shown in FIG. 1a, the slave device S2 sends a request 200 to the master device M requesting a BT 2.0 connection link with

the slave device S4. For example, the request can be sent in the form of an LMP (Link Manager Protocol) PDU, as shown in FIG. 2. Upon receiving the request, the master device M may respond to the request with three different PDUs, as listed in Table 1.

Description Paragraph (41):
It is likely that the channel conditions regarding carrier power C and/or interference and noise conditions (I) change during the data transfer between terminals HM and T1 (FIG. 1f). Thus, the selected frequency used for the current non-hopping channel may no longer be the best frequency for data transmission in the BT 2.0 connection link. To monitor the change in channel conditions, terminals HM and T1 can be adapted to monitor propagation characteristics and data flow quality in the used frequency channel. For example, the monitoring may include continuous averaging of RSSI, transmission power, average packet error rate, average bit error rate, used modulation/coding and data packet memory monitoring. These values are compared to radio quality of service (QoS) parameters, which are used as thresholds. If a threshold is not met, another frequency is selected for the new non-hopping channel. In general, among the BT 2.0 terminals (HM and T1 in this illustrative example) some are empowered to make a decision regarding the frequency to be used in the new BT 2.0 connection link while some are not. Thus, the non-decision-making terminals must report the threshold failure to the empowered terminals. In particular, a specific PDU, LMP_radioQoS_failure, can be used to report the threshold failure. This PDU may indicate which radio QoS criterion or criteria are not met and the current RSSI value, packet error rate, etc. The PDU can be used to report: a) whether the mean RSSI is above or below a certain threshold; b) whether the packet error rate exceeds a certain threshold; c) whether the transmission power exceeds a certain threshold; and d) whether the used modulation/code belongs to a feasible set of modulation/coding schemes.

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L3: Entry 11 of 25 File: USPT Nov 29, 2005

DOCUMENT-IDENTIFIER: US 6970495 B1
TITLE: Adjustment of slave frequency hopping pattern to improve channel measurement opportunities in wireless communications

Brief Summary Text (4):
Present telecommunication system technology includes a wide variety of wireless networking systems associated with both voice and data communications. An overview of several of these wireless networking systems is presented by Amitava Dutta-Roy, Communications Networks for Homes, IEEE Spectrum, pg. 26, December 1999. Therein, Dutta-Roy discusses several communication protocols in the 2.4 GHz band, including IEEE 802.11 direct-sequence spread spectrum (DSSS) and frequency-hopping (FHSS) protocols. A disadvantage of these protocols is the high overhead associated with their implementation. A less complex wireless protocol known as Shared Wireless Access Protocol (SWAP) also operates in the 2.4 GHz band. This protocol has been developed by the HomeRF Working Group and is supported by North American communications companies. The SWAP protocol uses frequency-hopping spread spectrum technology to produce a data rate of 1 Mb/sec. Another less complex protocol is named Bluetooth after a 10.sup.th century Scandinavian king who united several Danish kingdoms. This protocol also operates in the 2.4 GHz band and advantageously offers short-range wireless communication between Bluetooth devices without the need for a central network.

Brief Summary Text (5):
The Bluetooth protocol provides a 1 Mb/sec data rate with low energy consumption for battery powered devices operating in the 2.4 GHz ISM (industrial, scientific, medical) band. The current Bluetooth protocol provides a 10-meter range and an asymmetric data transfer rate of 721 kb/sec. The protocol supports a maximum of three voice channels for synchronous, CVSD-encoded transmission at 64 kb/sec. The Bluetooth protocol treats all radios as peer units except for a unique 48-bit address. At the start of any connection, the initiating unit is a temporary master. This temporary assignment, however, may change after initial communications are established. Each master may have active connections of up to seven slaves. Such a connection between a master and one or more slaves forms a "piconet." Link management allows communication between piconets, thereby forming "scatternets." Typical Bluetooth master devices include cordless phone base stations, local area network (LAN) access points, laptop computers, or bridges to other networks. Bluetooth slave devices may include cordless handsets, cell phones, headsets, personal digital assistants, digital cameras, or computer peripherals such as printers, scanners, fax machines and other devices.

Brief Summary Text (6):
The Bluetooth protocol uses time-division duplex (TDD) to support bi-directional communication. Spread-spectrum technology or frequency diversity with frequency hopping permits operation in noisy environments and permits multiple piconets to exist in close proximity. The frequency hopping scheme permits up to 1600 hops per second over 79 1-MHZ channels or the entire ISM spectrum. Various error correcting schemes permit data packet protection by 1/3 and 2/3 rate forward error correction. Further, Bluetooth uses retransmission of packets for guaranteed reliability. These schemes help correct data errors, but at the expense of throughput.

Brief Summary Text (7):
The Bluetooth protocol is specified in detail in Specification of the Bluetooth System, Version 1.0A, Jul. 26, 1999, which is incorporated herein by reference.

Detailed Description Text (2):
FIG. 1 diagrammatically illustrates one example of operations according to the present invention. The example of FIG. 1 relates to transmission of Bluetooth HV1 (High-quality Voice) packets between a master device M and a single slave device S. According to the invention, the slave device S transmits to the master M on the same frequency that the master will next transmit to the slave device according to the master's normal frequency hopping pattern. Thus, the master is advantageously given the opportunity to make channel measurements on frequencies f.sub.3, f.sub.5 and f.sub.7 immediately before transmitting on those respective frequencies, but without requiring the master to deviate from its own normal frequency hopping pattern. Therefore, the slave S can listen for the master's transmission on the frequency specified by the master's normal frequency hopping pattern, thus permitting the master to transmit to an ACL slave (or to transmit an ACL broadcast packet) without the above-described collision problem.

Detailed Description Text (12):
Referring again to FIG. 5, the quality measurements made at 54 can be used for purposes other than calculating weighting coefficients for multiple antennas, for example, selecting transmission parameters such as the channel coding rate (e.g., use higher coding rates in better quality conditions), the packet length (e.g., use longer packets in better quality conditions), and the transmission power level (e.g., use lower power in better quality conditions). This is shown generally at 54A in FIG. 8. It will be recognized that this type of transmit parameter selection operation is applicable even in devices that utilize only a single antenna, and the selection can be performed, for example, by the wireless communications interface 41 of FIG. 4.

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L16: Entry 12 of 29 File: USPT Nov 4, 2003

DOCUMENT-IDENTIFIER: US 6643817 B2
TITLE: Transmission system with adaptive channel encoder and decoder

Primary Examiner (1):
Ton; David

Brief Summary Text (3):
Such transmission systems can be used in applications where the quality of the transmission channel shows considerable variations. To enable a virtual error free transmission over such a transmission channel, in the transmitter the source symbols are encoded using a channel encoder according a code which has error correcting and/or error detecting capabilities. In the receiver the source symbols are reconstructed by a channel decoder. Useful codes can include convolutional codes and several types of block codes such as Reed-Solomon codes. Also a combination of a convolutional code with a block code is often used.

Brief Summary Text (4):
The ratio between the number of source symbols and the number of channel symbols of such a code is called the rate of the code. The error correction capabilities of such a code depend heavily on the rate of the code. In case of a transmission channel with a strongly varying transmission quality the rate of the used channel code should be chosen to obtain virtually error free transmission at the worst channel conditions. This leads to a loss of useful transmission capacity when the transmission quality is high.

Brief Summary Text (5):
To prevent this loss of transmission capacity, the transmission system can set the at least one coding property e.g. the rate of the channel encoder, in dependence on the transmission quality. It is further observed that it can be desirable to set the coding property of the channel encoder and decoder decoder in dependence of the type of source symbols to be transmitted. E.g. the transmission of data signals representing computer files, requires bit error rates below 10.sup.-10, and the transmission of digitized speech signal may require bit error rates only below 10.sup.-4.

Brief Summary Text (13):
A still further embodiment of the present invention is characterized in that the transmission system comprises transmission quality determining means for deriving a transmission quality measure from the channel decoder in the receiver, and means for transmitting via a further transmission channel the quality measure to the transmitter.

Brief Summary Text (14):
By using a return link from the receiver to the transmitter, it becomes easy to obtain a transmission quality at the transmitter. In a similar way, it is also possible to use transmission quality dependent channel encoding on a full duplex link.

Detailed Description Text (4):
The system controller 16 receives from the A-bis interface quality measures Q.sub.U

and Q.sub.D indicating the quality of the air interface 10 (radio channel) for the uplink and the downlink. The quality measure Q.sub.U is compared with a plurality of threshold levels, and the result of this comparison is used by the system controller 16 to divide the available channel capacity between the speech encoder 36 and the channel encoder 38 of the uplink. The signal Q.sub.D is filtered by low pass filter 22 and is subsequently compared with a plurality of threshold values. The result of the comparison is used to divide the available channel capacity between the speech encoder 12 and the channel encoder 14. For the uplink and the downlink four different combinations of the division of the channel capacity between the speech encoder 12 and the channel encoder 14 are possible. These possibilities are presented in the table below.

Detailed Description Text (5):
From Table 1 it can be seen that the bitrate allocated to the speech encoder 12 and the rate of the channel encoder increases with the channel quality. This is possible because at better channel conditions the channel encoder can provide the required transmission quality (Frame Error Rate) using a lower bitrate. The bitrate saved by the larger rate of the channel encoder is exploited by allocating it to the speech encoder 12 in order to obtain a better speech quality. It is observed that the coding property is here the rate of the channel encoder 14. The coding property setting means 15 are arranged for setting the rate of the channel encoder 14 according to the coding property supplied by the system controller 16.

Detailed Description Text (6):
Under bad channel conditions the channel encoder needs to have a lower rate in order to be able to provide the required transmission quality. The channel encoder will be a variable rate convolutional encoder which encodes the output bits of the speech encoder 12 to which an 8 bit CRC is added. The variable rate can be obtained by using different convolutional codes having a different basic rate or by using puncturing of a convolutional code with a fixed basic rate. Preferably a combination of these methods is used.

Detailed Description Text (21):
The channel decoder 28 provides at a fourth output a quality measure MMDd. This measure MMD can easily be derived when a Viterbi decoder is used in the channel decoder. This quality measure is filtered in the processing unit 32 according to a first order filter. For the output signal of the filter in the processing unit 32 can be written:

Detailed Description Text (22):
After the bitrate setting of the channel decoder 28 has been changed in response to a changed value of R.sub.D, the value of MMD'[n-1] is set to a typical value corresponding to the long time average of the filtered MMD for the newly set bitrate and for a typical downlink channel quality. This is done to reduce transient phenomena when switching between different values of the bitrate.

Detailed Description Text (23):
The output signal of the filter is quantized with 2 bits to a quality indicator Q.sub.D. The quality indicator Q.sub.D is applied to a second input of the channel encoder 38. The 2 bit quality indicator Q.sub.D is transmitted once each two frames using one bit position in each frame.

Detailed Description Text (27):
In the BTS 4, the signals from the channel encoder 38, received via the air interface 10, are applied to the channel decoder 44. The channel decoder 44 decodes its input signals, and passes the decoded signals via the A-bis interface 8 to the TRAU 2. The channel decoder 44 provides a quality measure MMDu representing the transmission quality of the uplink to a processing unit 46. The processing unit 46 performs a filter operation similar to that performed in the processing unit 32 and 22. Subsequently the result of the filter operation is quantized in two bits and

transmitted via the A-bis interface 8 to the TRAU 2.

Detailed Description Text (28):
In the system controller 16, a decision unit 20 determines the bitrate setting R.sub.U to be used for the uplink from the quality measure Q.sub.U. Under normal circumstances, the part of the channel capacity allocated to the speech coder will increase with increasing channel quality. The rate R.sub.U is transmitted once per two frames.

Detailed Description Text (31):
Again, under normal circumstances, the part of the channel capacity allocated to the speech coder will increase with increasing channel quality. Under special circumstances the signal R.sub.D can also be used to transmit a reconfiguration signal to the mobile station. This reconfiguration signal can e.g. indicate that a different speech encoding/decoding and or channel coding/decoding algorithm should be used. This reconfiguration signal can be encoded using a special predetermined sequence of R.sub.D signals. This special predetermined sequence of R.sub.D signals is recognised by an escape sequence decoder 31 in the mobile station, which is arranged for issuing a reconfiguration signal to the effected devices when a predetermined (escape) sequence has been detected. The escape sequence decoder 30 can comprise a shift register in which subsequent values of R.sub.D are clocked. By comparing the content of the shift register with the predetermined sequences, it can easily be detected when an escape sequence is received, and which of the possible escape sequences is received.

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DOCUMENT-IDENTIFIER: US 6460158 B1
TITLE: Transmission system with adaptive channel encoder and decoder

Primary Examiner (1):
Ton; David

Brief Summary Text (6):
Such transmission systems can be used in applications where the quality of the transmission channel shows considerable variations. To enable a virtual error free transmission over such a transmission channel, in the transmitter the source symbols are encoded using a channel encoder according a code which has error correcting and/or error detecting capabilities. In the receiver the source symbols are reconstructed by a channel decoder. Useful codes can include convolutional codes and several types of block codes such as Reed-Solomon codes. Also a combination of a convolutional code with a block code is often used.

Brief Summary Text (7):
The ratio between the number of source symbols and the number of channel symbols of such a code is called the rate of the code. The error correction capabilities of such a code depend heavily on the rate of the code. In case of a transmission channel with a strongly varying transmission quality the rate of the used channel code should be chosen to obtain virtually error free transmission at the worst channel conditions. This leads to a loss of useful transmission capacity when the transmission quality is high.

Brief Summary Text (8):
To prevent this loss of transmission capacity, the transmission system can set the at least one coding property e.g. the rate of the channel encoder, in dependence on the transmission quality. It is further observed that it can be desirable to set the coding property of the channel encoder and decoder decoder in dependence of the type of source symbols to be transmitted. E.g. the transmission of data signals representing computer files, requires bit error rates below 10.sup.-10, and the transmission of digitized speech signal may require bit error rates only below 10.sup.-4.

Brief Summary Text (17):
A still further embodiment of the present invention is characterized in that the transmission system comprises transmission quality determining means for deriving a transmission quality measure from the channel decoder in the receiver, and means for transmitting via a further transmission channel the quality measure to the transmitter.

Brief Summary Text (18):
By using a return link from the receiver to the transmitter, it becomes easy to obtain a transmission quality at the transmitter. In a similar way, it is also possible to use transmission quality dependent channel encoding on a full duplex link.

Detailed Description Text (5):
The system controller 16 receives from the A-bis interface quality measures Q.sub.U

and Q.sub.D indicating the quality of the air interface 10 (radio channel) for the uplink and the downlink. The quality measure Q.sub.U is compared with a plurality of threshold levels, and the result of this comparison is used by the system controller 16 to divide the available channel capacity between the speech encoder 36 and the channel encoder 38 of the uplink. The signal Q.sub.D is filtered by low pass filter 22 and is subsequently compared with a plurality of threshold values. The result of the comparison is used to divide the available channel capacity between the speech encoder 12 and the channel encoder 14. For the uplink and the downlink four different combinations of the division of the channel capacity between the speech encoder 12 and the channel encoder 14 are possible. These possibilities are presented in the table below.

Detailed Description Text (6):
From Table 1 it can be seen that the bitrate allocated to the speech encoder 12 and the rate of the channel encoder increases with the channel quality. This is possible because at better channel conditions the channel encoder can provide the required transmission quality (Frame Error Rate) using a lower bitrate. The bitrate saved by the larger rate of the channel encoder is exploited by allocating it to the speech encoder 12 in order to obtain a better speech quality. It is observed that the coding property is here the rate of the channel encoder 14. The coding property setting means 15 are arranged for setting the rate of the channel encoder 14 according to the coding property supplied by the system controller 16.

Detailed Description Text (7):
Under bad channel conditions the channel encoder needs to have a lower rate in order to be able to provide the required transmission quality. The channel encoder will be a variable rate convolutional encoder which encodes the output bits of the speech encoder 12 to which an 8 bit CRC is added. The variable rate can be obtained by using different convolutional codes having a different basic rate or by using puncturing of a convolutional code with a fixed basic rate. Preferably a combination of these methods is used.

Detailed Description Text (22):
The channel decoder 28 provides at a fourth output a quality measure MMDd. This measure MMD can easily be derived when a Viterbi decoder is used in the channel decoder. This quality measure is filtered in the processing unit 32 according to a first order filter. For the output signal of the filter in the processing unit 32 can be written:

Detailed Description Text (23):
After the bitrate setting of the channel decoder 28 has been changed in response to a changed value of R.sub.D, the value of MMD'[n-1] is set to a typical value corresponding to the long time average of the filtered MMD for the newly set bitrate and for a typical downlink channel quality. This is done to reduce transient phenomena when switching between different values of the bitrate.

Detailed Description Text (24):
The output signal of the filter is quantized with 2 bits to a quality indicator Q.sub.D. The quality indicator Q.sub.D is applied to a second input of the channel encoder 38. The 2 bit quality indicator Q.sub.D is transmitted once each two frames using one bit position in each frame.

Detailed Description Text (28):
In the BTS 4, the signals from the channel encoder 38, received via the air interface 10, are applied to the channel decoder 44. The channel decoder 44 decodes its input signals, and passes the decoded signals via the A-bis interface 8 to the TRAU 2. The channel decoder 44 provides a quality measure MMDu representing the transmission quality of the uplink to a processing unit 46. The processing unit 46 performs a filter operation similar to that performed in the processing unit 32 and 22. Subsequently the result of the filter operation is quantized in two bits and

transmitted via the A-bis interface 8 to the TRAU 2.

Detailed Description Text (29):
In the system controller 16, a decision unit 20 determines the bitrate setting R.sub.U to be used for the uplink from the quality measure Q.sub.U. Under normal circumstances, the part of the channel capacity allocated to the speech coder will increase with increasing channel quality. The rate R.sub.U is transmitted once per two frames.

Detailed Description Text (32):
Again, under normal circumstances, the part of the channel capacity allocated to the speech coder will increase with increasing channel quality. Under special circumstances the signal R.sub.D can also be used to transmit a reconfiguration signal to the mobile station. This reconfiguration signal can e.g. indicate that a different speech encoding/decoding and or channel coding/decoding algorithm should be used. This reconfiguration signal can be encoded using a special predetermined sequence of R.sub.D signals. This special predetermined sequence of R.sub.D signals is recognised by an escape sequence decoder 31 in the mobile station, which is arranged for issuing a reconfiguration signal to the effected devices when a predetermined (escape) sequence has been detected. The escape sequence decoder 30 can comprise a shift register in which subsequent values of R.sub.D are clocked. By comparing the content of the shift register with the predetermined sequences, it can easily be detected when an escape sequence is received, and which of the possible escape sequences is received.

CLAIMS:

4. The transmission system according to claim 1, wherein the transmission system comprises transmission quality determining means for deriving a transmission quality measure from the at least first channel decoder in the receiver, and means for transmitting via a further transmission channel the quality measure to the transmitter.

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